CHECKLIST

Iraq Nat. Hist. Mus. Publ.
(May, 2020) no. 37, 16 pp.

Checklist of Mayflies (Ephemeroptera, Insecta) from Iraq

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Received Date: 05January 2020, Accepted Date: 11 May 2020, Published Date: 31 May 2020

Abstract

This work provides the updated checklist of the mayfly (Ephemeroptera) fauna of Iraq; it consists of 30 species belonging to 18 genera and 10 families.

The highest number of species belongs to the families of Baetidae and Heptageniidae, whereas the lowest in Ephemeridae, Leptophlebiidae and Palingeniidae that appeared with only one species for each of them. The current investigation is a contribution to the knowledge regarding the biodiversity of mayflies, with mentioning the synonyms of the species and correcting the scientific names that found in previous publications in Iraq.

Keywords: Ephemeroptera, Insecta, Iraq, Mayflies, Museum.

Introduction

Ephemeroptera with two pairs of wings; the fore much wider than the hind wings, which in some genera are reduced in size or even wholly absent; venation system is of considerable importance in classification; further small veins locate between the main veins are termed intercalary veins. Mouth parts entirely vestigial; compound eyes of male larger than at female, divided in some species, and the

upper part prominent as turret shaped; forelegs in males often extremely long; abdominal terminates with two or three long and many jointed filaments, the median one in certain genera being reduced; the male carries a pair of jointed claspers arising from a plate on the 9thsternite (Kimmins, 1950). Uniquely among insects, they possess paired genitalia, the male having two aedeagi and the female with two gonopores (McCafferty, 1983).

This group is one of the two present orders of Palaeoptera (oldest Pterygota) along with Odonata (Edmunds and McCafferty, 1988). Ephemeroptera was founded from the Carboniferous and Permian periods and represent the oldest order of the existing winged insects; they are unique among the insects in having two winged adult stages, the subimago and imago. Because of their winged adult stage and a tendency to drift as nymphs, these insects are often among the first macro-invertebrates to colonize virgin habitats. However, over longer distances their distribution ability is restricted, owing to their weakness and short adult life (Brittain and Sartori, 2009).

The first try to reconstruct the phylogeny of these insects are done by Edmunds (1962), then McCafferty and Edmunds (1979) split the mayflies in two suborders, Pannota (with 13 families: Ametropodidae, Baetidae, Behningiidae, Ephemeridae, Euthyplociidae, Heptageniidae, Leptophlebiidae, Metretopodidae, Oligoneuriidae, Palingeniidae, Polymitarcyidae, Potamanthidae and Siphlonuridae); and Schistonota (with 6 families: Baetiscidae, Caenidae, Ephemerellidae, Neoephemeridae, Prosopistomatidae and Tricorythidae). Mayflies comprise a well-supported monophyletic group of pterygote insects (Hovmöller *et al*., 2002; Ogden and Whiting, 2005).

This guild is worldwide distribution, being absent only from Arctic region, Antarctica and some remote oceanic islands (Barber-James *et*

al., 2008); they include over 3000 species and distributed in 42 described families (Sartori and Brittain, 2015).

Some regions such as the United Arab Emirates and several parts of Arabian Peninsula are comparatively well known (Thomas and Sartori, 1989; Sartori and Gillies, 1990; Gattolliat and Sartori, 2008). In Kuwait, Al-Houty (2011) reported one species only, also there were a few species reported from Jordan by Gattolliat *et al*. (2012), and may be due to the insufficient studies about this order. On the other hand, Kazanciand Türkmen (2012) conducted a checklist of Ephemeroptera in Turkey; they reported 14 families, 39 genera, 138 species and 5 subspecies. In Iran, Bojková *et al*. (2018) presented a list of this group, which includes 46 species and 25 genera; in addition, they described 18 new species that have been addedto insect fauna of Iran; later, Sroka*et al*. (2019) added a new species *Oligoneuriella tuberculata* Godunko & Staniczek (Oligoneuriidae).

In Iraq, the studies on this order were somewhat got more attention in comparison with neighboring areas, for example: Al-Zubaidi and Al-Kayatt (1986), as they surveyed on this order in northern Iraq; followed by Al-Zubaidi *et al*. (1987), they conducted a study on Ephemeroptera, and Shekha (2011)who recorded ten species in a study of benthic macroinvertebrate community in the lower part of the Greater Zab River near Guwer subdistrict, northern Iraq; then Bojková and Soldán (2015)added a new species *Prosopistoma helenae* from Tigris River in Mosul city; on the other hand, this insects was not mentioned in the previous checklists for Iraq.

The aim of this review is to present the first checklist and update with the correction of the scientific names of which reported previously in Iraq on mayflies. The synonyms checked with those of Landa (1969); Hubbard (1990), Jacobus *et al*. (2004); Haybach (2008);

Salur *et al*. (2016) and updating information on the website of the Global Biodiversity Information Facility (GBIF Secretariat, 2019).

List of the species of mayflies in Iraq

Taxa	References
Family Baetidae	
Genus *Baetis* Leach, 1815	
= *Boetis* Adelung, 1903	
= *Brachyphlebia* Westwood, 1840	
= *Neobaetiella* Müller-Liebenau, 1985	
= *Patites* Thomas & Dia, 1999	
= *Rhodobaetis* Jacob, 2003	
= *Tatubaetis* Kang & Yang, 1994	
Baetis buceratus Eaton, 1870	(Al-Zubaidi and Al-Kayatt, 1986)
= *Baetis grandii* Grandi, 1948	
= *Baetis scanicus* Bengtsson, 1917	
Baetis lutheri Müller-Liebenau, 1967	(Al-Zubaidi *et al*., 1987)
= *Baetis venustulus* Eaton, 1885	
Baetis rhodani (Pictet, 1843)	(Al-Zubaidi and Al-Kayatt, 1986)
= *Baetis bocagii* Eaton, 1885	
= *Baetis iberi* Navás, 1913	
= *Baetis pusillus* Bengtsson, 1912	
= *Baetis wallengreni* Bengtsson, 1912	
= *Cloe rhodani* Pictet, 1843	
Baetis vardarensis Ikonomov, 1962	(Al-Zubaidi and Al-Kayatt, 1986)
Baetis vernus Curtis, 1834	(Shekha, 2011)
= *Baetis finitimus* Eaton, 1871	
= *Baetis phaeops* Eaton, 1870	
=*Baetis tenax* Eaton, 1870	

Taxa	References

Genus *Cloeon* Leach, 1815

= *Austrocloeon* Barnard, 1940
= *Chloeopsis* Causard, 1896
= *Chloë* Agassiz, 1846
= *Chloëon* Lubbock, 1863
= *Cleon* Samouelle, 1819
= *Cloe* Burmeister, 1839
= *Cloëopsis* Eaton, 1866
= *Intercloeon* Kluge & Novikova, 1992
= *Neocloeon* Traver, 1932

Cloeon dipterum (Linnaeus, 1761) (München, 1989)

= *Ephemera annulata* O. F. Müller, 1776
= *Ephemera dimidiata* O. F. Müller, 1776
= *Chleon dipterum* (Linnaeus, 1758)
= *Chloeon dipterum* (Linnaeus, 1761)
= *Cloe affinis* Rambur, 1842
= *Cloe apicalis* Costa, 1882
= *Cloe diptera* (Linnaeus, 1761)
= *Cloeon dimidiatum* Curtis, 1834
= *Cloeon pallida* Leach, 1815
= *Cloeon rufulum* (O. F. Müller, 1776)
= *Cloeon sgezedi* Jacob, 1969
= *Cloeo psisdiptera* (Linnaeus, 1761)
= *Ephemera diptera* Linnaeus, 1761
= *Ephemera rufulum* O.F.Müller, 1776

Cloeon simile Eaton, 1870 (München, 1989)

= *Cloeon viride* Schneider, 1885
= *Procloeon rabaudi* Verrier, 1949
= *Similicloeon simile* (Eaton, 1870)

Family Caenidae

Genus *Brachycercus* Curtis, 1834

= *Eurycaenis* Bengtsson, 1917

Taxa	References

Brachycercus harrisella (Curtis, 1834) (Shekha, 2011)
= *Brachycercus arcticus* Soldán, 1986
= *Brachycercus magnus* Tshernova, 1952
= *Brachycercus pallidus* Tshernova, 1928
= *Caenis harrisella* (Curtis, 1834)
= *Caenis pennata* Stephens, 1835
= *Eurycaenis harrisella* (Curtis, 1834)

Genus *Caenis* Stephens, 1836
= *Austrocaenis* Barnard, 1932
= *Caeneus* Eaton, 1888
= *Caenodes* Ulmer, 1924
= *Caenomedea* Thew, 1960
= *Caenus* Agassiz, 1846
= *Ordella* Campion, 1923
= *Oxycypha* Burmeister, 1839
= *Pseudocaenis* Soldan, 1978

Caenis horaria (Linnaeus, 1758) (Shekha, 2011)
= *Caenis dimidiata* Stephens, 1835
= *Caenis lactella* Eaton, 1884
= *Ephemera horaria* Linnaeus, 1758

Caenis macrura Stephens, 1835 (Al-Zubaidi *et al*., 1987)
= *Caenis grisea* Pictet, 1845
= *Caenis halterata* (Fabricius, 1777)
= *Caenis interrupta* Stephens, 1835
= *Ephemera brevicauda* Fabricius, 1793

Caenis pseudorivulorum Keffermüller, 1960 (München, 1989)
= *Caenis beskidensis* Sowa, 1973

Family Ephemeridae
Genus *Ephemera* Linnaeus, 1758
= *Aethephemera* McCafferty & Edmunds, 1974
= *Nirvius* Navás, 1922

Taxa	References

= *Sinephemera* Kluge, 2004

Ephemera sp. (Hassan *et al*., 2000)

Family Ephemerellidae

Genus *Serratella* Edmunds, 1959

= *Ephemerella* (*Serratella*) Edmunds, 1959

Serratella ignita (Poda, 1761) (Al-Zubaidi *et al*., 1987)

= *Baetis obscura* Stephens, 1836
= *Ephemera apicalis* Stephens, 1836
= *Ephemera diluta* Stephens, 1836
= *Ephemera ignita* Poda, 1761
= *Ephemera rosea* Stephens, 1836
= *Ephemera rufescens* Stephens, 1836
= *Ephemerella ignita* (Poda, 1761)
= *Ephemerella lactate* Bengtsson, 1909
= *Ephemerella sibirica* Tshernova, 1952
= *Ephemerella torrentium* Bengtsson, 1917
= *Potamanthus aeneus* Pictet, 1843
= *Potamanthus gibbus* Pictet, 1843

Genus *Torleya* Lestage, 1917

Torleya major (Klapalek, 1905) (Al-Zubaidi *et al*., 1987)

= *Ephemerella major* Klapalek, 1905
= *Torleya belgica* Lestage, 1917
= *Torleya nazarita* Alba-Tercedor and Derka, 2003

Family Heptageniidae

Genus *Afronurus* Lestage, 1924

= *Cinygmina* Kimmins, 1937

Afronurus kugleri Demoulin, 1973 (Al-Zubaidi and Al-Kayatt, 1986)

= *Afronurus kugleri* Samocha, 1972

Taxa	References
= *Afronurus kugleri* Dia, 1983	
= *Afronurus kugleri* Moubayed, 1986	
= *Afronurus kugleri* Koch, 1988	
Genus *Ecdyonurus* Eaton, 1868	
= *Ecdyurus* Eaton, 1868	
=*Helvetoraeticus* Bauernfeind & Soldán, 2012	
Ecdyonurus sp.	(Shekha, 2011)
Genus *Epeorus* Eaton, 1881	
= *Alpiron* Braasch, 2006	
= *Caucasiron* Kluge, 1997	
= *Iron* Eaton, 1883	
= *Ironopsis* Traver, 1935	
= *Proepeorus* Kluge, 2004	
Epeorus nigripilosus (Sinitshenkova, 1976)	(Al-Zubaidi and Al- Kayatt, 1986)
= *Iron nigipilosus* Sinitshenkova, 1976	
Epeorus zaitzevi Tshernova, 1981	(Al-Zubaidi *et al*., 1987)
= *Epeorus zaitcevi* Tshernova, 1981	
= *Epeorus zaitcevi* Kazanci & Braasch, 1988	
=*Epeorus zaicevi* Koch, 1988	
=*Epeorus znojkoi* Braasch, 1978	
Genus *Heptagenia* Walsh, 1863	
= *Parastenacron* Kluge, 1983	
= *Sigmoneuria* Demoulin, 1964	
Heptagenia sulphurea (Müller, 1776)	(Shekha, 2011)
= *Ephemera sulphurea* O. F. Müller, 1776	
= *Heptagenia elegans* (Curtis, 1834)	

Taxa	References
Genus *Rhithrogena* Eaton, 1881 = *Himalogena* Kluge, 2004 = *Rhitrogena* Klapálek, 1905 = *Sibirigena* Kluge, 2004 = *Tumungula* Zhou & Peters, 2004	
Rhithrogena expectata Braasch, 1979	(Al-Zubaidi *et al*., 1987)
Rhithrogena semicolorata (Curtis, 1834) = *Baetis semicoloratus* Curtis, 1834 = *Rhithrogena grisoculata* Bogoescu, 1958 = *Rhithrogena semitincta* Pictet, 1843 = *Rhithrogena vulpecula* Klapalek, 1905	(Shekha, 2011)
Family Isonychiidae **Genus *Isonychia*** Eaton, 1871 = *Borisonychia* McCafferty, 1989 = *Eatonia* Rashid Ali, 1970 = *Jolia* Eaton, 1881 = *Prionoides* Kondratieff & Reese Voshell, 1983	
Isonychia arabica Al-Zubaidi, Braasch and Al-Kayatt, 1987	(Al-Zubaidi *et al*., 1987)
Isonychia sp.	(Shekha, 2011)
Family Leptophlebiidae **Genus *Choroterpes*** Eaton, 1881 = *Dilatognathus* Kluge, 2012 = *Monophyllus* Kluge, 2012	
Choroterpes picteti (Eaton, 1871) =*Choroterpes lusitanica* Eaton, 1881 =*Leptophlebia picteti* Eaton, 1871	(München, 1989)

Taxa	References
Family Oligoneuriidae	
Genus *Oligoneuriella* Ulmer, 1924	
Oligoneuriella bicaudata Al-Zubaidi, Braasch and Al-Kayatt, 1987	(Al-Zubaidi *et al*., 1987)
Oligoneuriella tskhomelidzei Sowa and Zosidze, 1973 = *Oligoneuriella baskale* Soldán and Landa, 1977 = *Oligoneuriella zanga* Soldan and Landa, 1977	(Al-Zubaidi *et al*., 1987)
Genus *Oligoneuriopsis* Crass, 1947	
Oligoneuriopsis sp.	(Al-Zubaidi and Al-Kayatt, 1986)
Family Palingeniidae	
Genus *Mortogenesia* Lestage, 1923	
Mortogenesia mesopotamica (Morton, 1921) = *Palingenia mesopotamica* Morton, 1921	(Morton, 1921)
Family Prosopistomatidae	
Genus *Prosopistoma* Latreille, 1833 = *Chelysentomon* Joly, 1872 = *Chelysentomon* Joly, 1872 = *Binoculus* Fourcroy, 1785 = *Binoculus* Demoulin, 1954	
Prosopistoma helenae Bojková and Soldán (2015)	(Bojková and Soldán, 2015)
Prosopistoma sp.	(Shekha, 2011)

Discussion

Formerly, some species that recorded in Iraq under the synonym names were included: *Epeorus nigripilosus* (Sinitshenkova, 1976) registered as *Iron nigipilosus* Sinitshenkova, 1976 by Al-Zubaidi and Al-Kayatt (1986); then *Torleya major* (Klapalek, 1905) recorded as *Ephemerella major* Klapalek, 1905) and the species of *Oligoneuriella tskhomelidzei* Sowa & Zosidze, 1973 was reported under the name *Oligoneuriella zanga* Soldán & Landa 1977 by Al- Zubaidi *et al*. (1987).

Finally, München (1989) reported *Cloeon simile* Eaton in the fauna of Iraq, but he mentioned the year 1871 instead of 1870 after the author name in his paper.

Acknowledgment

The family of the deceased Prof. Dr. M. S. Abdul-Rassoul (May God have mercy on him) grateful to Prof. Dr. Razzaq Shalan Augul and Assist. Prof. Dr. Hanaa Hani Al-Saffar, Iraq Natural History Research Center and Museum, University of Baghdad; also thanks to Assist. Prof. Dr. Hayder Badri Ali, College of Science, University of Baghdad for their review and checking of scientific names before submitting this work to the editorial board of this publication.

We thank the administration of the Natural History Research Center and Museum for their support and encouragement to us in disseminating this scientific upshot.

References

Al-Houty, W. 2011. Recent insect fauna of Kuwait. *Kuwait Journal of Science and Engineering*, 38 (1A): 81-92.

Al-Zubaidi, F. and Al-Kayatt, A. 1986. A preliminary survey of mayflies from the north of Iraq. *Journal of Biological Sciences Research*, 17(2): 147-151.

Al-Zubaidi, F., Braasch, D. and Al-Kayatt, A. 1987. Mayflies from Iraq (Insecta, Ephemeroptera). *Faunistische Abhandlungen, Staatliches Museum für Tierkunde Dresden*, 14: 179–184.

Barber-James, H., Gattolliat, J-L., Sartori, M. and Hubbard, M. D. 2008. Global diversity of mayflies (Ephemeroptera, Insecta) in freshwater. *Hydrobiologia*, 595: 339–350.

Bojková, J. and Soldán, T. 2015.Two new species of the genus *Prosopistoma* (Ephemeroptera: Prosopistomatidae) from Iraq and Algeria. *Zootaxa*, 4018(1):109-23.

Bojková, J., Sroka, P., Soldán, T., Imanpour Namin, J., Staniczek, A. H., Polášek, M., Hrivniak, L., Abdoli, A. and Godunko, R. J. 2018. Initial commented checklist of Iranian mayflies (Insecta: Ephemeroptera), with new area records and description of *Procloeon caspicum* sp. n. (Insecta, Ephemeroptera, Baetidae). *ZooKeys*, 749: 87–123.

Brittain, J. E. and Sartori, M. 2009. Ephemeroptera, p 328-333. *In*: Resh, V. H. and Cardé, R. T. Encyclopedia of insects, 2nd edition. London: Elsevier/Academic Press.

Edmunds, G. F.1962. The principles applied in determining the hierarchic level of the higher categories of Ephemeroptera. *Systematic Zoology*, 11:22–31.

Edmunds, G. F. and McCafferty, W. P. 1988. The mayfly subimago. *Annual Review of Entomology*, 33: 509-529.

Gattolliat, J.-L. and Sartori, M. 2008. Order Ephemeroptera. p. 47-83. *In*: van Harten, A. (Ed.), Arthropod fauna of the United Arab Emirates, vol. 1. Dar Al Ummah, Abu Dhabi, UAE.

Gattolliat, J.-L., Vuataz, L. and Sartori, M. 2012. First contribution to the mayflies of Jordan. *Zoology in the Middle East*, 56: 91–110.

GBIF Secretariat 2019. GBIF Backbone Taxonomy. Checklist dataset https://doi.org/10.15468/39omei accessed via GBIF.org on 20-01-0220.

Hassan, K. S., Habeeb, M. A. and Al-Mousawi, N. J. 2000. Occurrence of aquatic insects with algae in Basrah province. *Marina Mesopotamica*, 15:137-143.

Haybach, A. 2008. Catalogue of the mayflies of Germany, Austria and Switzerland and their synonyms (Insecta, Ephemeroptera). *Mainzer Naturhistorisches Archiv*, Beiheft 32, 75pp.

Hubbard, M. D. 1990. Mayflies of the world: a catalogue of the family and genus group taxa. Flora & Fauna handbook no. 8, CRC Press, 136 pp.

Hovmöller, R., Pape, T. and Källersjo, M. 2002. The Palaeoptera problem: basal Pterygote phylogeny inferred from 18S and 28S rDNA sequences. *Cladistics*, 18: 313–323.

Jacobus, L. M., Zhou, C. -F. and McCafferty, W. P. 2004. Revisionary contributions to the genus *Torleya* (Ephemeroptera: Ephemerellidae). *Journal of the New York Entomological Society*, 112 (2-3):153–175.

Kazanci, N. and Türkmen, G. 2012. The checklist of Ephemeroptera (Insecta) species of Turkey. *Review of Hydrobiology*, 5: 143–156.

Kimmins, D. E. 1950. Ephemeroptera. Handbooks for the identification of British Insects, Royal Entomological Society of London, Vol. I, Part 9, 20 pp.

Landa, V. 1969. Jepice-Ephemeroptera. *In*: Fauna CSSR, Svazek 18, Academia Praha, 347 pp.

McCafferty, W. P. 1983. "Mayflies". Aquatic entomology: the fishermen's and ecologists' illustrated guide to insects and their relatives. Jones & Bartlett, p. 91–123.

McCafferty, W. P. and Edmunds, G. F. Jr. 1979. The higher classification of the Ephemeroptera and its evolutionary basis. *Annals of the Entomological Society of America*, 72 (1): 5-12.

Morton, K. J. 1921. A new species of mayfly, *Palingenia* (sensulato), from Mesopotamia. *The Entomologist*, 54: 177–180.

München, M. C. 1989.The ecology of a Wadi in Iraq with particular reference to colonization strategies of aquatic microinvertebrates. *Archivfür Hydrobiologie*, 116, 4: 499-515.

Ogden, T. H. and Whiting, M. F. 2005. Phylogeny of Ephemeroptera (mayflies) based on molecular evidence. *Molecular Phylogenetics and Evolution*, 37: 625–643.

Salur, A., Darilmaz, M. C. and Bauernfeind, E. 2016. An annotated catalogue of the mayfly fauna of Turkey (Insecta, Ephemeroptera). *ZooKeys*, 620: 67–118.

Sartori, M. and Brittain, J. E. 2015. Order Ephemeroptera. *In*: Thorp, J. H. and Rogers, D. C. (eds), Thorp and Covich's freshwater invertebrates, Chapter 34, 4th edition. Boston: Academic Press, p. 873–91.

Sartori, M. and Gillies, M. T. 1990. Further records of mayflies (Insecta: Ephemeroptera) from the Arabian Peninsula. Leptophlebiidae and Baetidae. *Fauna of Saudi Arabia*, 11: 10-17.

Shekha, Y. A. 2011. A study of benthic macroinvertebrate community in the lower part of Greater Zab River near Guwer subdistrict. *Rafidain Journal of Science*, 22 (1): 33- 45.

Sroka, P., Bojková, J., Godunko, R. J., Soldán, T., Namin, J. I., Nejat, F., Abdoli, A. and Staniczek, A. 2019. New Oligoneuriidae (Insecta, Ephemeroptera) from Iran. *ZooKeys*, 872: 101–126.

Thomas, A. G. B. and Sartori, M. 1989. Mayflies (Insecta, Ephemeroptera) of Saudi Arabia. *Fauna of Saudi Arabia*, 10: 87-94.

Iraq Nat. Hist. Mus. Publ.
(May, 2020) no. 37 ,16 pp.

قائمة مرجعية لرتبة ذباب مايو (Ephemeroptera, Insecta)من العراق

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تأريخ الاستلام: 5 /1 /2020، تأريخ القبول: 11 / 5/2020 ، تأريخ النشر: 31/ 5/2020

الخلاصة

يوفر هذا العمل قائمة المراجعة المحدثة للحشرات التابعة لرتبة ذباب مايو Ephemeroptera في العراق ؛ حيث تضمنت الدراسة 28 نوعًا تنتمي إلى 17 جنسًا و 10 عائلات.

وجد ان أكبر عدد من الأنواع يعود إلى عائلتي Baetidae و Heptageniidae،في حين أن أقل عدد لهذه الرتبة كان بواقع نوعا واحدا لكل من العوائل Ephemeridae وLeptophlebiidae و Palingeniidae.

المراجعة الحالية هي اسهام في المعرفة حول التنوع الأحيائي لذباب مايو، مع الاشارة إلى ذكر مرادفات الأنواع و تصحيح بعض الاسماء العلمية التي وجدت في النشريات السابقة.